

GAMATRONIC's MODULAR UPS INSTALLATION WITH 4-POLE ATS

INTRODUCTION

The input power to most installations with critical load comes from more than just a single source. In many cases, the load is powered from a generator when the mains source fails. In this case an Automatic Static Switch (ATS) is used to transfer the power source from mains power to generator and vice-versa. In many cases the ATS switches the phases, while the neutrals of both sources are solid connected and grounded (fig1). In this installation the change-over transfer between the sources are performed without over-voltages between phases and neutral.

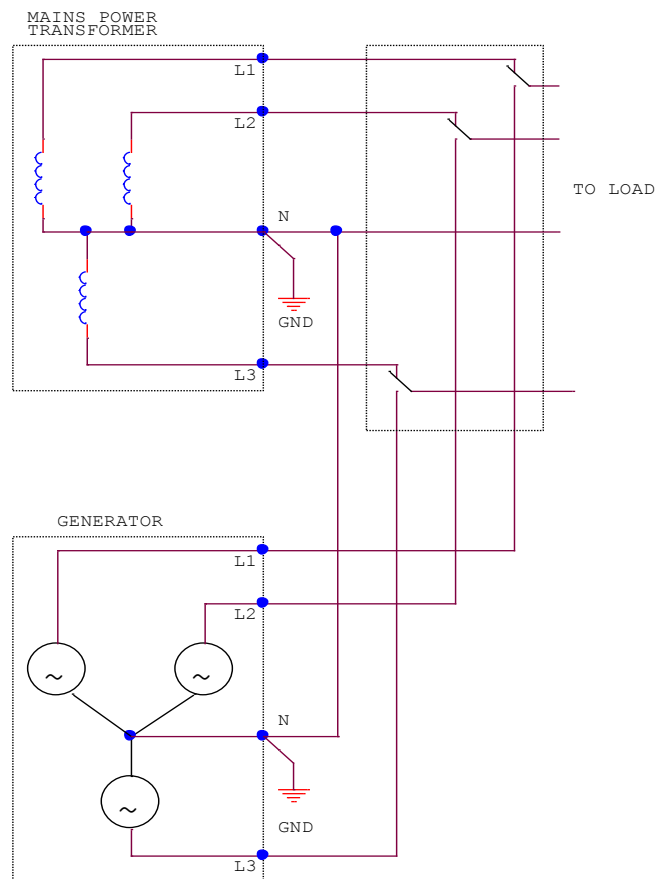


Fig.1 ATS installation with solid connected neutrals

However, many domestic regulations, like NEC 230.95, require to install Ground Fault Protection devices (GFP) interrupting the power source if leakage to ground is detected (fig.2). In this case circulation currents between two grounding points in installation with solid state neutral could affect the GFP activity or cause unwillingness trip of GFP system.

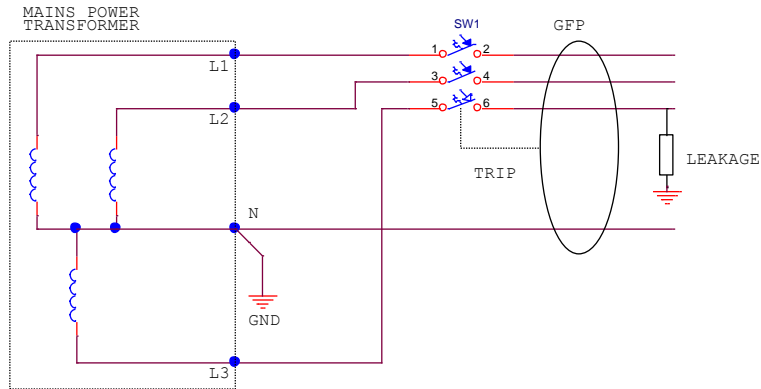


Fig. 2 Ground Fault Protection

In this case a 4-pole ATS is used to switch the neutral between power sources (fig.3).

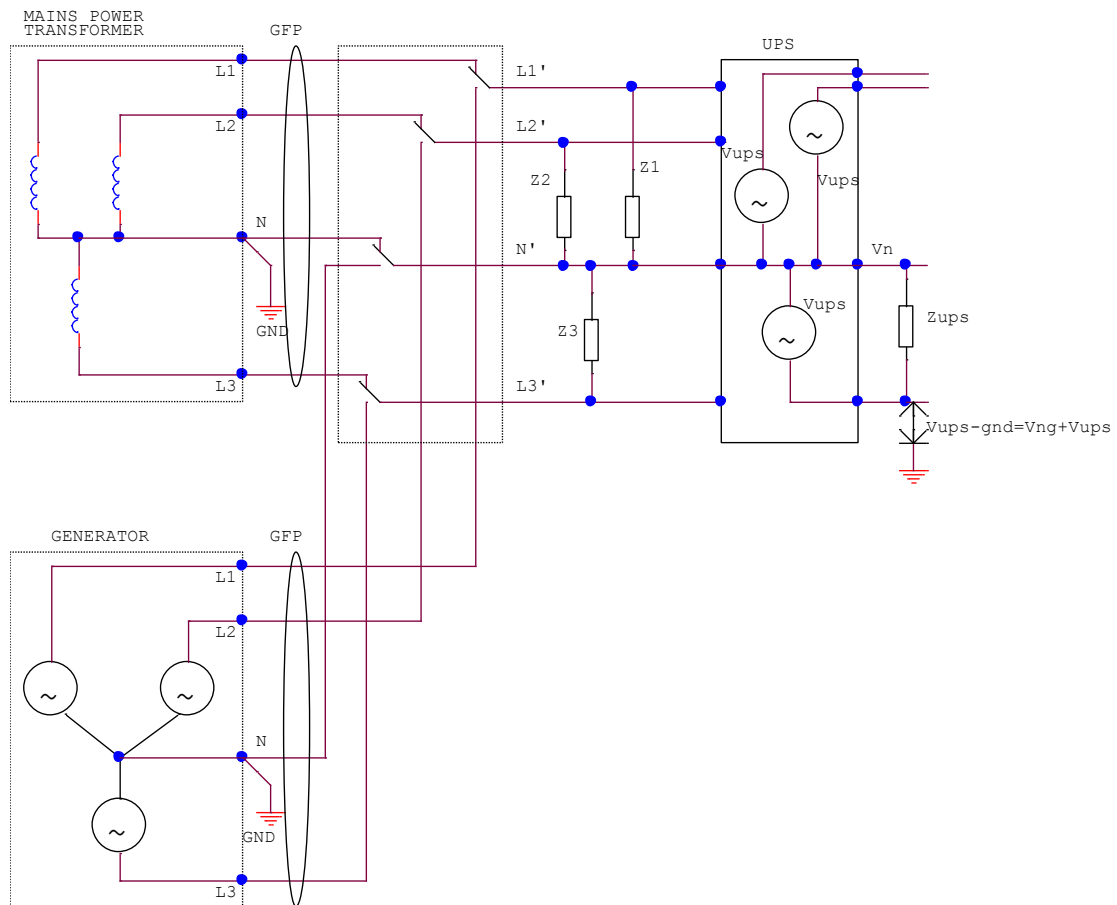


Fig 3. Installation with UPS and 4-pole ATS

In this case current circulation between ground points could be prevented and GFP action is guaranteed. However, if the neutral switch is disconnected before phase disconnection or is connected after phase connection, the point N' became floating and its potential regarding GND V_{n-g} depends from impedances of load in the building Z_1, Z_2, Z_3 . In case of unbalanced load, the value of V_{n-g} could be equal to phase-to-gnd voltage. The load must be able to keep this extra-voltage applied at time of transfer ($\sim 100\text{ms}$). When a transformer-less UPS is connected to this installation, it provides stabilized phase-neutral voltage V_{ups} . When the neutral is floating, the output voltage of UPS regarding GND is vectorial sum of V_{ups} and V_{n-gnd} . In worst case, twice value of phase-gnd voltage could be applied between load's phase and ground. It could affect the load, especially when its protection varistor between phase and ground has the clamp voltage lower than $2 \cdot V_{\text{phase-neutral}}$. **This is a common problem for all transformer-less UPS's installed with 4-pole ATS.**

SOLUTIONS

There are two possible solutions of the problem:

- 1) Usage of insulation transformer at UPS input, providing separate neutral for UPS loads
- 2) Special construction of ATS, preventing the possibility of floating neutral when phases of power sources are connected.

In its turn, the second solution has two options:

- a) ATS with overlapping neutrals when the neutral switch has make-before-break feature. Example of this unit is ASCO ATS 7000 series code "C". Note than during switching both mains and generator's neutrals are connected together therefore two ground points exist for short time. To prevent a false trip, GFP action must be delayed for 0.2-0.5S.
- b) ATS with delayed neutral connection-disconnection when the neutral switching is performed breaking last- making first (GE Zenith ZTS series). In these devices load's neutral remains floating during transfer time that could be long when generator is started.

CONCLUSIONS

Gamatronic's transformer-less modular UPS systems of Power Plus, Centric A, Centric B families must be used with ATS at one of three possible installations:

- 1) With 3-pole ATS at solid neutrals connection
- 2) With isolation transformer providing separate neutral for UPS loads. Any ATS could be used in this case.
- 3) With 4-pole ATS with overlapping neutral (like ASCO 7000 series code "C"). GFP, if exists, must acts with delay 0.2-0.5S. Example of 4-pole ATS with overlapping neutral for 400A 400V is ASCO J7ATSC3400J5. Type of GFP is Schneider Electric GC-200 Ground Fault Relay or similar

REFERENCES

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2. *Transfer Switches. Overlapping neutral. Cutler-Hammer Canada, technical bulletin #2001.*
3. *ASCO 7000 ATS Operator's manual. ASCO Power Technologies L.P.2007*
4. *GE Critical Power Zenith Automatic Transfer Switch. Operation and Maintenance Manual, rev 08/2015.*